

RESEARCH ARTICLE

Blockchain governance for refugee credentialing: A framework for inclusive higher education

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Abstract

Refugees and displaced learners, including asylum seekers, face significant barriers to the recognition of prior learning and qualifications across borders. Lost documentation, fragmented recognition systems, limited transparency and weak data protection restrict access to higher education, professional mobility and social inclusion. Blockchain offers potential for secure and portable credential verification, but its use in refugee higher education remains underexplored from a governance perspective. This qualitative study draws on 36 interviews across 16 countries with participants spanning refugee education, higher education, technology, policy and humanitarian practice, including four participants with direct lived experience as refugee learners or displaced professionals. Thematic analysis identified five governance principles: stakeholder collaboration, transparency and trustworthiness, data integrity and security, cost-effective implementation and flexible verification. Grounded in the Capability Approach, Collaborative Governance Theory, and IGF and UNESCO principles, the study proposes a governance framework for blockchain-based refugee credentialing. The findings show that digital credentialing can support inclusion only when governed through user agency, interoperability, privacy protection and institutional recognition.

Keywords Inclusive Education; Blockchain Governance; Certificate Verification; Refugees; Higher Education

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Introduction

As of late 2023, the global displaced population reached 117 million, according to the United Nations High Commissioner for Refugees (UNHCR, 2024). This growing demographic faces persistent and multifaceted barriers to accessing education, challenges that are particularly acute for refugees, here understood as people who have been forcibly displaced across international borders, including both recognised refugees and asylum seekers. Despite the prominence of education in the United Nations

Sustainable Development Goals (SDGs), especially SDG 4, which frames education as a cornerstone of sustainable development and global well-being (Saxena et al., 2021), refugee learners across diverse host-country settings, including high-resource and major refugee-hosting contexts, continue to encounter significant obstacles in pursuing higher education and having their prior learning recognised. In this study, the term ‘displaced learners’ is used to encompass refugees, asylum seekers, and other forcibly displaced individuals engaged in higher education pathways.

Among the most pressing issues for displaced learners are the loss of academic records, legal and administrative constraints, and the absence of mechanisms for cross-border credential recognition (Ungar & Seymour, 2024). As a result, global refugee enrolment in higher education remains critically low (just 7%), highlighting systemic gaps in policy implementation and institutional support (UNHCR, 2024). This enrolment shortfall is multi-causal, reflecting legal status, language barriers, financial precarity, and prior schooling disruption. Among these, credential verification represents a tractable and actionable constraint that uniquely intersects with technological intervention. The inability to present verifiable academic credentials not only impedes educational advancement but also deepens socio-economic marginalisation and limits opportunities for integration (Diedrich, 2025). Framed through the lens of the Capability Approach (Nussbaum, 2003; Sen, 1999), the inability to evidence prior learning is not merely an administrative inconvenience but a substantive curtailment of refugees' capability to convert educational attainment into functioning opportunities for work, further study, and civic participation.

Blockchain technology is a decentralised digital ledger that records transactions across a distributed network, enabling secure and verifiable data exchange without reliance on a central authority. It has emerged as a promising solution to the credentialing challenges (Christ & Helliard, 2021; Nakamoto, 2008). Blockchain-enabled platforms allow displaced learners to securely store, authenticate, and share academic credentials across borders, enhancing both the credibility and portability of their qualifications (Harini et al., 2025; Tan et al., 2023). Initiatives such as the European Blockchain Services Infrastructure (EBSI) demonstrate the feasibility of using blockchain to support transnational recognition of educational credentials. Although EBSI was developed primarily for EU citizens, its architecture for issuer accreditation, verifiable credentials, and cross-jurisdictional trust establishes design precedents directly relevant to non-EU populations, including refugees seeking recognition across multiple host states.

However, the ethical, inclusive, and scalable implementation of blockchain in refugee education contexts hinges on the development of robust governance frameworks, an area that remains underexplored (de Alwis et al., 2025). Without such frameworks, blockchain deployments risk fragmented adoption, interoperability failures across jurisdictions, and inadequate safeguards for the privacy and data sovereignty of displaced populations. Current efforts are often hindered by fragmented stakeholder coordination among higher education institutions (HEIs), accreditation bodies, and policy actors, as well as by the absence of standardised protocols to ensure authenticity, interoperability, and trust (Loo, 2023).

This study addresses this critical gap by investigating how governance frameworks can support the integration of blockchain technology into higher education systems serving displaced populations. Specifically, it aims to (a) examine how

multi-stakeholder actors including refugee learners, educators, technologists, policymakers, and humanitarian practitioners perceive and navigate existing governance arrangements for blockchain credentialing in refugee higher education contexts; (b) Identify key governance-related challenges and opportunities associated with blockchain adoption in refugee credentialing systems; and (c) Propose a tailored governance framework to support the secure, inclusive, and scalable implementation of blockchain in higher education for displaced populations, offering practical recommendations for policymakers, institutions, and humanitarian actors. In doing so, the study responds to the dual imperative of advancing inclusive higher education for displaced populations under SDG 4 and informing the design of digital trust infrastructures that operate ethically across jurisdictional, institutional, and humanitarian boundaries.

Literature review

Refugee education and credential recognition barriers

Education is central to the United Nations Sustainable Development Goals, particularly SDG 4, which frames inclusive and equitable quality education as a foundation for sustainable development and social participation (Saxena et al., 2021). For refugees and displaced learners, however, access to higher education is often constrained not only by admission requirements, tuition costs or language barriers, but also by difficulties in proving prior learning and qualifications. Academic records may have been lost, destroyed, left behind, or issued by institutions that are inaccessible because of conflict, displacement or administrative breakdown. These challenges limit access to higher education, professional mobility and social inclusion in host countries (Ungar & Seymour, 2024; UNHCR, 2024).

Recognition of prior learning (RPL) provides one response to this problem. RPL allows prior educational achievement, professional experience and competencies to be assessed where conventional documentation is incomplete or unavailable. Andersson (2021, 2024) argues that RPL can support the labour market integration of skilled refugees and migrants by affirming professional identity and enabling prior learning to be translated into recognised opportunities. However, RPL processes often remain dependent on institutional discretion, local policy settings and the availability of sufficient evidence. Where refugees cannot provide trusted documentation, or where qualifications are not accepted across borders, RPL may be difficult to implement consistently.

The European Qualifications Passport for Refugees (EQPR) offers a more refugee-specific recognition mechanism. It enables refugees without full documentation to have their qualifications assessed through structured interviews and available evidence. This provides an important pathway for recognising prior learning when formal records are missing.

However, EQPR is not legally binding, and its practical value depends on whether higher education institutions, employers and public authorities accept the assessment outcome (Scardigno et al., 2024). This highlights a wider limitation: existing recognition mechanisms can support displaced learners, but they remain fragmented, unevenly adopted and difficult to scale across jurisdictions.

Taken together, the literature shows that refugee credential recognition is not only an administrative issue but a governance problem. Displaced learners require recognition systems that are portable, trusted, flexible and sensitive to incomplete documentation. Existing mechanisms such as RPL and EQPR provide important foundations, but they do not fully resolve the challenges of cross-border verification, institutional trust and scalable recognition. This creates the need to examine whether digital credentialing infrastructures, including blockchain-supported systems, can strengthen recognition while remaining inclusive, rights-sensitive and practically usable for refugees and displaced learners.

Blockchain-based credentialing in education

Blockchain technology has attracted growing attention as a potential infrastructure for educational credentialing because it can support secure, tamper-resistant and verifiable records that are portable across institutions and jurisdictions (Dewangan et al., 2023). In education, blockchain is most relevant not as a repository for storing full academic records, but as a mechanism for establishing the provenance and authenticity of credentials. Authorised issuers, such as higher education institutions, recognition bodies or approved credentialing agencies, can issue digital credentials or anchor cryptographic proofs of those credentials on a blockchain. Learners may then hold and share these credentials through digital wallets or equivalent access systems, while verifiers such as universities, employers, professional bodies or public authorities can check whether the credential was issued by a trusted authority and has not been tampered with.

This distinction between issuing, holding and verifying credentials is important. In most educational credentialing contexts, learners are not the parties who add academic credentials to the blockchain. Rather, trusted issuers create or validate the credential, while learners control how it is shared through digital wallets or equivalent access mechanisms (Grech et al., 2021; Tan et al., 2023). Similarly, viewing or verifying a credential is not the same as authoring or adding a record to the blockchain. A university admissions office or employer may verify a credential through a QR code, digital wallet or verification portal, but this does not mean that they can alter the underlying record (Delgado-von-Eitzen et al., 2021; Maestre et al., 2023). Where corrections, appeals or revocations are required, these are normally handled through off-chain governance processes and reflected through updated credential states, revocation registries or new credential records, rather than by changing an earlier blockchain record (Grech et al., 2021; Tan et al., 2023).

For refugee and displaced learners, this model is relevant because academic records may be lost, inaccessible or difficult to authenticate across borders. Blockchain-supported credentialing may reduce reliance on fragile paper documents and slow manual verification by enabling trusted issuers to provide verifiable evidence of qualifications, micro-credentials, recognition of prior learning outcomes or bridging program achievements (Jirgensons & Kapenieks, 2018; Turkanović et al., 2018).

The European Blockchain Services Infrastructure (EBSI), for example, demonstrates how digital wallets and verifiable credentials can support cross-border educational verification (Tan et al., 2023). Although EBSI was not designed specifically for refugees, its approach to trusted issuers, verifiable credentials and cross-jurisdictional trust provides a useful precedent for refugee credentialing systems.

However, blockchain should not be treated as a complete solution to credential recognition. Its technical features, including decentralisation, immutability and cryptographic verification, may strengthen trust in the integrity of a credential, but they do not automatically guarantee institutional recognition. A credential may be technically verifiable but still unusable if higher education institutions, employers, professional bodies or public authorities do not accept it. Blockchain credentialing is therefore best understood as a socio-technical system: technical infrastructure can support provenance and verification, but governance arrangements determine who is authorised to issue credentials, who can verify them, how learner consent is obtained, how errors or disputes are managed, and whether verified credentials are recognised in practice (Grech et al., 2021; Liu et al., 2022).

Governance, interoperability, and data protection

The effective use of blockchain in refugee credentialing depends on governance across the wider credentialing ecosystem, not only on the technical design of the ledger. In higher education, credential recognition involves multiple actors, including universities, ministries, recognition and quality assurance bodies, professional associations, employers, humanitarian organisations and technology providers. Governance is therefore concerned with defining who is authorised to issue or validate credentials, who may verify them, how consent is obtained, how data access is controlled, how disputes or corrections are handled, and how recognition decisions are made across institutional and national boundaries (Ansell & Gash, 2008; Emerson et al., 2012; Liu et al., 2023).

Interoperability is central to this governance challenge. Displaced learners often move across countries, institutions and employment systems, while higher education recognition processes are usually organised through national regulations, institution-specific procedures and siloed databases (Chu & Westerheijden, 2019). Blockchain-supported credentialing may provide common verification

infrastructure, but technical interoperability alone is insufficient. For credentials to be useful, universities, employers and public authorities must agree on trusted issuers, credential formats, verification protocols, recognition rules and accountability mechanisms. In this sense, the problem is not simply whether an employer's HR system connects to multiple blockchains, but whether verifiers can reliably interpret and trust credential evidence issued across different systems.

Data protection is equally important because refugee credentialing involves sensitive personal information. Educational records may reveal identity, migration history, location, legal status or interrupted educational pathways. Blockchain's immutability can strengthen record integrity, but it can also create risks if personal data is permanently recorded, over-collected or difficult to correct. For this reason, refugee credentialing systems should avoid placing sensitive personal information directly 'on-chain'. Instead, privacy-preserving designs can store personal data off-chain while using blockchain to anchor hashes, proofs, timestamps or verification records. Selective disclosure, consent-based access and privacy-by-design are therefore central safeguards for credentialing systems serving displaced learners (Delgado-von-Eitzen et al., 2021; Maestre et al., 2023; Singh et al., 2020).

Governance must also address inclusion and access. Refugees and displaced learners may face limited internet access, low digital literacy, lack of devices, language barriers, unstable legal status and limited institutional support. These conditions affect whether digital credentials can be used, even where the technical infrastructure is sound. Alnafrah and Mouselli (2021) argue that blockchain-based academic record systems must be adapted for low-resource contexts rather than assuming universal digital access. Governance frameworks for refugee credentialing therefore need to address not only standards, privacy and institutional roles, but also affordability, usability, multilingual support, learner assistance and non-digital backup pathways.

Together, these issues show that blockchain credentialing is a socio-technical governance problem. Secure records and cryptographic verification are useful only when embedded in rules, institutions and support systems that make credentials recognisable, privacy-preserving and practically usable for displaced learners.

International policy reference points: IGF, UNESCO, EBSI, and EQPR

International policy and practice frameworks provide important reference points for designing blockchain-based credentialing systems for displaced learners. The Internet Governance Forum (IGF) is relevant because it promotes multi-stakeholder participation, openness, transparency and inclusive governance in digital systems (Internet Governance Forum, n.d.). These principles are applicable to refugee credentialing because recognition depends on coordination among public authorities, higher

education institutions, humanitarian organisations, employers, technology providers and learners. UNESCO's work on digital credentialing and education further emphasises equitable access, education as a public good, and the importance of recognised learning across borders (Chakroun & Keevy, 2018; Wals, 2014). Together, IGF and UNESCO provide normative guidance for ensuring that digital credentialing systems are transparent, inclusive and accountable.

EBSI and EQPR provide more operational reference points. EBSI demonstrates how trusted issuers, verifiable credentials and digital wallets can support cross-border verification of educational records (Tan et al., 2023). Although EBSI was developed primarily in a European context, its architecture offers design insights for credentialing systems that require institutional trust across jurisdictions. EQPR, by contrast, is directly relevant to refugee recognition because it provides a structured process for assessing qualifications where full documentation is unavailable. However, EQPR depends on institutional acceptance and is not legally binding, which limits its scalability and enforceability across countries (Scardigno et al., 2024).

These four reference points are not treated in this study as complete solutions. Rather, they inform the development of the proposed governance framework. IGF and UNESCO provide principles of inclusive, transparent and rights-sensitive digital governance, while EBSI and EQPR demonstrate practical approaches to digital verification and flexible recognition. Their combined relevance lies in showing that blockchain credentialing for displaced learners must integrate technical verification, institutional recognition, data protection and learner agency. This study therefore uses them as policy and practice benchmarks against which interview findings are interpreted, and the proposed framework is critically assessed for coherence and policy alignment.

Theoretical lens and research gap

This study is theoretically grounded in the Capability Approach and Collaborative Governance Theory. These theories were selected because they jointly address the two dimensions central to blockchain-based refugee credentialing: the expansion of displaced learners' substantive opportunities and the coordination of multiple institutions required to make credentials trusted and usable. The Capability Approach provides a normative lens for examining whether credentialing systems expand refugees' real freedoms to access education, employment and social participation (Nussbaum, 2003; Sen, 1999). Refugees may possess prior qualifications and professional skills, yet structural barriers such as lost documentation, institutional mistrust, legal restrictions, language barriers and fragmented recognition systems can prevent those capabilities from being converted into meaningful opportunities.

Collaborative Governance Theory complements this perspective by explaining how multiple stakeholders coordinate action in complex policy environments (Ansell & Gash, 2008; Emerson et al., 2012). Blockchain

credentialing cannot be effective as a technical platform alone. It depends on shared rules, trusted issuers, institutional recognition, data protection and accountability mechanisms (Grech et al., 2021; Liu et al., 2023). These arrangements are especially important in refugee credentialing because recognition involves actors across different institutions and jurisdictions, including governments, higher education institutions, employers, humanitarian organisations, technology providers and displaced learners (Ansell & Gash, 2008; Emerson et al., 2012; Loo, 2023). Collaborative Governance Theory is therefore useful for analysing how these actors coordinate credential recognition where authority is distributed rather than held by a single institution.

Alternative theoretical perspectives, including Institutional Theory, Accountability Theory and socio-technical approaches, are relevant to aspects of this problem. However, the Capability Approach and Collaborative Governance Theory were selected because they most directly connect the individual and institutional dimensions of refugee credentialing: whether verified credentials expand displaced learners' opportunities, and how actors coordinate to make those credentials recognised in practice. In this study, blockchain credentialing is therefore analysed as both a capability-enabling infrastructure and a collaborative governance challenge.

Despite extensive research on refugee credential recognition and blockchain governance, these literatures remain insufficiently integrated, particularly in relation to data protection, institutional recognition, and learner agency (Andersson, 2024; Limata et al., 2024; Scardigno et al., 2024). However, existing research has not sufficiently integrated refugee credential recognition, blockchain governance, data protection, institutional recognition and learner agency into a single governance framework. Blockchain governance literature has examined decentralisation, trust, interoperability and accountability, while refugee education literature has focused on access, RPL, portability and recognition barriers. While blockchain enables verifiable credential infrastructure, its effectiveness depends on governance arrangements that determine how credentials are issued, trusted and recognised.

Our research addresses this integration gap by combining qualitative findings from educators, technologists, policymakers, humanitarian actors and a small number of refugee participants with international policy and practice reference points, including IGF, UNESCO, EBSI and EQPR. It develops a governance framework for blockchain-based refugee credentialing that explains how digital verification can support recognition only when embedded in stakeholder collaboration, transparency, data integrity, cost-effective implementation and flexible verification.

Methodology

Research design and rationale

This study used a qualitative, multi-stakeholder research design to develop a governance framework for blockchain-based refugee credentialing in higher education. A qualitative approach was appropriate because the study examined the institutional, ethical and governance conditions required for blockchain implementation in refugee and displaced learner contexts (Sherman & Webb, 2004). The research design addressed three objectives: (a) to examine existing policy and governance reference points relevant to blockchain-based credentialing in refugee higher education; (b) to analyse and explain governance-related challenges and opportunities associated with blockchain adoption in refugee credential recognition; and (c) to develop and justify a tailored governance framework to support secure, inclusive and scalable blockchain-based credentialing for displaced learners.

Two sources of evidence were used. Semi-structured interviews captured lived, institutional, technical and policy perspectives on credential recognition and blockchain governance. Comparative policy/framework analysis connected these findings to four international reference points: the Internet Governance Forum, UNESCO, the European Blockchain Services Infrastructure and the European Qualifications Passport for Refugees. Together, these sources enabled the study to examine empirical experiences of credential recognition while interpreting them against relevant international policy and practice benchmarks.

Participants and sampling

A purposive sampling strategy was used to recruit 36 participants from 16 countries. Participants were selected because of their experience or expertise in refugee education, higher education, recognition of prior learning, credential verification, digital identity, blockchain technology, internet governance, policy development or humanitarian education systems.

The sample included a small number of refugee and asylum-seeker voices, educators, higher education representatives, technologists, digital credentialing and identity verification providers, policymakers and humanitarian actors. The sample included four participants with direct lived experience as refugee learners or displaced professionals, alongside humanitarian and refugee education actors who contributed programme-level perspectives on refugee access, documentation and support systems. This multi-stakeholder sample reflected the governance problem under investigation: blockchain credentialing for displaced learners depends on coordination among learners, issuers, verifiers, policymakers, humanitarian actors and technology providers.

Table 1*Participant categories and contribution to the study*

Stakeholder category	Participant codes	Main contribution
Refugee learners and displaced professionals	R31, R33, R34, R35	Lived experience of credential loss, recognition barriers, mobility and retraining
Humanitarian/NGO and refugee education actors	R13, R30, R32	Refugee education delivery, access constraints and support systems
Higher education academics and educators	R01, R02, R06, R09, R14 R20, R22	Recognition, RPL, institutional processes and academic governance
Technology/blockchain and verification specialists	R23- R29, R36	Blockchain credentialing, digital identity, verification, data integrity and implementation
Employer/verifier and policy/governance representatives	R03 - R12, R21	Employer verification, institutional trust, policy and governance implications

Note. R31 is included as a refugee learner/displaced professional because the participant contributed lived experience as a Ukrainian refugee student, while also offering professional insight as a technologist/co-founder.

Data collection

Semi-structured interviews were conducted via Zoom between March 2024 and April 2025. Interviews lasted approximately 45 to 60 minutes and were audio-recorded with participant consent before being transcribed for analysis. The interview protocol was adapted to participants' roles (Harrell & Bradley, 2009). Refugee-related participants were not expected to assess blockchain architecture; instead, their interviews focused on credential loss, recognition barriers, access to higher education and portability of qualifications, while blockchain-specific governance and implementation questions were directed to participants with technical, policy or institutional expertise.

Comparative policy and framework analysis

Comparative analysis of four reference points complemented the interviews. IGF and UNESCO contributed governance principles for inclusive digital systems, including multi-stakeholder participation, transparency, rights-based access and ethical technology use. EBSI provided a practical example of blockchain-enabled credential infrastructure, while EQPR provided a refugee-specific recognition model for learners with incomplete documentation. These reference points were used as interpretive benchmarks to contextualise empirical findings, i.e., the interview themes were compared to ensure the framework was both empirically grounded and policy aligned.

Data analysis

A hybrid thematic analysis combined inductive coding of interview data with deductive mapping against literature and selected policy frameworks. Transcripts were coded in NVivo following Braun and Clarke's six-phase process of familiarisation, coding, theme development, theme review, theme definition and reporting (Braun & Clarke, 2019). Because the study followed reflexive thematic analysis, coding rigour was established through iterative coding, theme refinement, reflexive memoing and an audit trail rather than inter-coder reliability testing or kappa

scores. The analysis was also theoretically informed by the Capability Approach (Nussbaum, 2003; Sen, 1999) and Collaborative Governance Theory (Ansell & Gash, 2008; Emerson et al., 2012), which guided the interpretation of themes relating to learner agency and institutional coordination.

Initial codes were generated from participant accounts of credential recognition barriers, institutional trust, privacy, verification, cost, digital access and stakeholder coordination. These codes were grouped into broader themes and compared with governance principles in IGF, UNESCO, EBSI and EQPR. Five interrelated governance principles emerged: stakeholder collaboration, transparency, data integrity, cost-effectiveness and flexible verification.

Ethics and trustworthiness

Ethical approval was granted by the University # Human Research Ethics Committee. Participants received information on study purpose, voluntary participation, confidentiality and the right to withdraw. Informed consent was obtained, data were stored securely and identities were anonymised using participant codes. Additional care was taken with refugee-related participants by avoiding questions requiring disclosure of traumatic experiences and reminding participants that they could skip questions, pause or stop the interview at any time. Trustworthiness was supported through credibility, transferability, dependability and confirmability (Lincoln & Guba, 1985). Credibility was strengthened through triangulation across interviews, literature and comparative policy sources. Transferability was supported by participant category descriptions, dependability by an audit trail of coding and theme development, and confirmability by reflexive journaling.

Findings

The analysis identified five interrelated governance themes shaping blockchain-based credentialing for displaced learners: stakeholder collaboration, transparency and trustworthiness, data integrity and security, cost-effective implementation, and flexible

verification. These themes are treated as governance conditions rather than technical features. They show how displaced learners' ability to have prior learning recognised depends not only on the existence of digital credentials, but also on coordinated institutions, trusted verification processes, privacy-preserving data practices, affordable access and flexible recognition pathways. Drawing on the participant groups outlined in Table 1, the findings integrate lived experience accounts from refugee and displaced participants with institutional, technical, humanitarian and policy perspectives. Together, they provide the empirical basis for the governance framework developed in Section 5.

Fragmented responsibility and the need for stakeholder collaboration

A central finding from the interviews was that credential recognition for displaced learners is experienced as fragmented, uncertain and dependent on individual effort. Refugee participants emphasised that they did not see recognition as a single administrative process. Rather, they described disconnected interactions with universities, ministries, embassies, professional bodies, employers, NGOs and host-country authorities. Where these actors were not coordinated, displaced learners were left to navigate recognition pathways alone.

R33 described the absence of structured support in direct terms:

"Unfortunately nothing designed or nothing, let's say, structured for that. It's just personal efforts here and there sometimes." - R33, refugee participant.

R31 similarly identified authentication and validation as one of the most difficult barriers for displaced learners:

"The biggest problem is authentication and validation of qualifications... because many people lost all their documents. They don't have any proof that they graduated from university or school." - R31, Ukrainian refugee student

These accounts show that credential recognition problems extend beyond missing documents. The absence of a coordinated validation pathway shifts the burden of proof onto displaced learners, even where displacement has made conventional proof difficult or impossible. In this sense, fragmented responsibility becomes a form of administrative exclusion: learners may possess qualifications but cannot convert them into recognised educational or professional opportunities because no single actor is responsible for enabling verification.

Institutional participants also emphasised that trust cannot be produced by technology alone. One higher education participant explained:

"There needs to be a robust system of trust management and that takes more than just technology, it will require the evolution, novel institutions, evolution at institutional level and greater cooperation UNESCO level intervention may be required to provide governance." - R14, higher education expert

These perspectives show that blockchain credentialing requires an ecosystem of trusted issuers, verifiers and governance authorities with clear roles and obligations, not a digital platform alone. Without institutional cooperation, legitimate qualifications remain difficult to authenticate, making stakeholder collaboration a core governance principle rather than an implementation detail. These findings suggest IGF and UNESCO-informed approaches that frame multi-stakeholder participation, accountability and inclusive access are important conditions for trustworthy digital systems. The interviews extend this literature by showing that stakeholder coordination is not merely a procedural norm but a precondition for determining whether displaced learners can access recognition pathways at all. These findings indicate that credential verification challenges are fundamentally shaped by governance conditions, rather than technical limitations.

Transparency, trustworthiness, and user agency in verification

The second theme, transparency and trustworthiness, emerged from participant accounts of opaque validation processes, inconsistent recognition decisions and the need for user-controlled disclosure. For refugee participants, transparency was closely connected to uncertainty: when qualifications are lost, inaccessible or issued by institutions in conflict-affected regions, displaced learners need to understand how prior learning will be assessed, what evidence will be accepted, who is responsible for validation and whether the outcome will be trusted by universities, employers or recognition bodies.

R33 described how credential validation could depend on embassy and ministry processes that remained largely manual:

"They have Palestinian embassy here and they have Ministry of Education under that. They have a lot of things to be accredited... most of the time manually." - R33, refugee participant

This shows that transparency is not only about making records visible. It also concerns who controls validation, what process is followed and whether the outcome will be trusted by universities, employers or recognition bodies.

Participants also discussed decentralised identifiers (DIDs) as a mechanism for user control. DIDs allow individuals to prove selected attributes without relying solely on a central authority and can support selective disclosure in credentialing systems (Singh et al., 2020). While not inherently blockchain-based, DIDs are often used in blockchain credentialing architectures where decentralised verification is required. As one technologist explained:

“DIDs allow users to share what’s needed, only when needed, and that’s powerful for people like refugees.” - R29, technologist

For displaced learners, this means that verification systems should allow individuals to disclose only the information required for a specific purpose, while retaining greater control over who can access their educational or personal records and how those records are used.

The importance of consent and data ownership was also emphasised by a verification provider. R28 explained that, in their platform, the requesting party must provide evidence of the individual’s consent before accessing records:

“The requesting party... also have to give us the consent of that particular individual for whose detail they want to read.” - R28, technologist / verification provider

Together, these accounts show that trustworthiness depends on governance rules about consent, ownership, access and accountability, not technical verification alone. Manual validation, inconsistent standards and reliance on issuing institutions affect the wider credentialing system, but their consequences are more severe for displaced learners who may no longer have original documents or stable communication channels.

The findings extend literature on digital trust infrastructure and verifiable credentials by showing that transparency is a governance requirement enabling displaced learners to understand, control and contest how their records are used, not merely a technical property of blockchain. For the proposed framework, transparent verification therefore requires explainable processes, consent-based disclosure, auditability and institutional accountability. These findings demonstrate that trust in credentialing systems depends on explainable verification processes, user control, and institutional accountability, rather than system architecture alone.

Lost documents, invisible skills, and the need for data integrity

The third theme concerned the integrity and security of educational records. For displaced learners, records are not merely administrative documents; they are evidence of educational identity, professional capability and prior learning. When records are lost or untrusted, learners may be unable to prove qualifications already earned, limiting educational and professional reintegration. R33 described how the absence of records can make professional skills invisible:

“Many people in the camps were doctors, teachers, engineers... but without documents, their skills go unseen. It’s what we call ‘brain abuse’.” — R33, refugee participant

R33’s account reframes data integrity as more than a technical issue. “Brain abuse” captures how qualified individuals can be prevented from using their skills because systems cannot verify what they know or

have achieved. This highlights the governance failure of verification systems.

R31 similarly linked displacement to authentication and validation problems:

“The biggest problem is authentication and validation of qualifications... because many people lost all their documents. They don’t have any proof that they graduated from university or school.” - R31, Ukrainian refugee student / technologist-co-founder

Together, these accounts reveal a circular problem of proof: displaced learners need recognised credentials to access education, employment or professional pathways, yet the evidence required for recognition may have been destroyed or rendered inaccessible by conflict. A credentialing system reliant on original paper documents can therefore reproduce exclusion.

Technologists and verification providers reinforced the operational importance of data integrity. R28 explained how digitisation can improve access to validated information:

“The digitisation process also enables background verification agencies to quickly access validated alumni information.” - R28, verification provider

This shows that data integrity has both protective and enabling functions: it protects records from tampering, loss and unauthorised alteration while enabling timely verification by institutions, employers and background checking agencies. For displaced learners, delays or uncertainty in verification can prevent access to study, work, professional registration or retraining.

These findings indicate that identifying secure, tamper-resistant and verifiable records are central to blockchain-based credentialing and resonate with Andersson’s (2024, p. 31) account of “brain abuse.” The interviews extend this literature by reframing data integrity as the preservation of educational and professional identity, not only fraud prevention.

For the proposed framework, data integrity and security are therefore not only technical safeguards against tampering. They are governance conditions that protect the evidentiary value of prior learning, support trusted verification, and provide recovery pathways for learners whose documents are incomplete, inaccessible or lost. These findings reveal that data integrity is a governance condition that determines whether prior learning can be recognised and acted upon.

Cost barriers and the need for affordable verification

The fourth theme concerned the cost of credential verification and the affordability of digital solutions. Participants described existing verification processes as expensive, slow and administratively burdensome for both institutions and individuals. For displaced learners, these costs are intensified by interrupted employment, relocation costs, limited access to issuing institutions and uncertainty about legal or educational status.

Technologists and credentialing providers described traditional verification as resource intensive. R26 explained that employers often spend significant time and money confirming whether qualifications are genuine:

“Most of the companies spend tons of money to actually check the people they are hiring and the certificates are valid. But the entire process itself is very expensive and slow.” - R26, technologist

R25 similarly described the financial and time cost of retrieving certificates:

“Even retrieving a certificate... there is a cost associated with it. So I would say in dollars, it would be around... \$50.” - R25, technologist

R35, an African refugee student, also highlighted the financial and institutional barriers associated with formal qualification assessment:

“Engineering qualification assessment costs thousands - no waivers for refugees.” - R35, African refugee student

These accounts show that cost includes not only fees, but also repeated checks, administrative labour and delays. For displaced learners, such costs can become exclusionary when credentials must be verified across multiple countries, institutions or employers.

Credentialing providers also described digital platforms as a way to reduce repeated manual checks and improve access to validated records. However, affordability must be assessed from the perspective of displaced learners, not only institutions or employers. A system that reduces employer verification costs but introduces new fees, device requirements or connectivity barriers for refugees would not be equitable.

Although R13 referred more broadly to the need for scalable and low-cost education technologies, this perspective is relevant to credentialing because any digital verification system designed for refugee learners must be affordable within low-resource education and humanitarian settings. These findings indicate that digital divide and refugee education, which emphasises that technology-based solutions, must account for affordability, connectivity and institutional capacity.

For the proposed framework, cost-effectiveness requires affordable issuance and verification, transparent fees, minimal repeated checks and funding models that do not shift costs onto displaced learners. These findings suggest that affordability is a central governance constraint shaping access to credential verification, particularly for displaced learners operating in low-resource contexts.

Mobility, partial recognition, and flexible verification

The fifth theme concerned the need for flexible verification services that support displaced learners across countries, institutions and employment

pathways. Participants described mobility as an ongoing condition affecting education, retraining and access to work, not a single relocation event. Verification systems must therefore be portable, interoperable and able to accommodate incomplete records.

R31, drawing on both lived experience as a Ukrainian refugee student and professional experience as a technologist-co-founder, emphasised that education and identity records need to remain usable when learners move:

“We need systems that work even if people are on the move, education and identity should follow them.” - R31, Ukrainian refugee student / technologist-co-founder

R33 similarly linked verification to opportunity across countries:

“It is important that their qualifications are recognised and able to be verified to gain opportunities in other countries.” - R33, refugee participant

These accounts show that flexible verification involves more than digitising credentials. It requires qualifications to be interpreted, trusted and used across jurisdictions, including where learners have partial records, professional experience or prior learning but lack original documentation. R34's account further illustrates the link between mobility, retraining and recognition: *“I moved to Germany for better state support and the opportunity to retrain and work in my field”* (R34).

Flexible verification must therefore connect to RPL, bridging programmes, retraining pathways and professional re-entry, so displaced learners are not required to restart education or training they have already completed. These findings highlight that portable credential systems and refugee qualification frameworks support partial recognition and plausibility assessment. The interviews extend this literature by positioning flexibility as a governance requirement that determines whether displaced learners can translate prior education into future opportunity.

For the proposed framework, flexible verification means that credentialing systems must accommodate partial documentation, prior learning, professional experience, multilingual access, retraining pathways and cross-border recognition, rather than requiring displaced learners to restart education or reproduce documents that displacement has made unavailable. These findings highlight that portability and flexibility are essential governance requirements for credentialing systems operating across jurisdictions and incomplete documentation contexts.

Taken together, all five themes derived from the findings provide empirical evidence for the governance principles developed in the following section. Critically, these findings shift the focus from technological capability to governance conditions as the primary determinant of credential recognition.

Table 2*Empirical findings, governance requirements, and supporting literature*

Framework principle	Empirical problem from Section 4	Governance requirement	Supporting literature/frameworks
Stakeholder collaboration	Recognition is fragmented and dependent on personal effort	Define roles and accountability for issuers, verifiers, HEIs, ministries, NGOs, employers and technology providers	IGF; UNESCO; Ansell & Gash (2008); Emerson et al. (2012); Liu et al. (2023)
Transparency and trustworthiness	Verification processes are opaque, manual or inconsistent	Ensure explainable verification, consent-based disclosure, auditability and user agency	EBSI; Tan et al. (2023); Grech et al. (2021); Liu et al. (2022); Singh et al. (2020)
Data integrity and security	Lost or unverifiable records make prior learning invisible	Provide tamper-resistant, privacy-preserving and recoverable credential records	Delgado-von-Eitzen et al. (2021); Maestre et al. (2023); Harini et al. (2025)
Cost-effective implementation	Verification involves fees, delays and repeated checks	Reduce repeated verification, clarify fees and support low-resource implementation	Alnafrah & Mouselli (2021); UNHCR (2024); Saxena et al. (2021)
Flexible verification	Learners need recognition across borders and incomplete records	Support portability, RPL, partial recognition, multilingual access and professional re-entry	Andersson (2021, 2024); EQPR; Scardigno et al. (2024); Limata et al. (2024); Ungar & Seymour (2024)

Framework development

Framework rationale

Building on the empirical findings in Section 4, this section develops a governance framework for blockchain-based credentialing in refugee education. The framework integrates the five interview-derived themes with relevant literature and international governance reference points, including the Internet Governance Forum, UNESCO-informed principles, the European Blockchain Services Infrastructure and the European Qualifications Passport for Refugees. Each governance principle directly corresponds to themes identified in Section 4, ensuring that the framework is empirically grounded. This framework treats blockchain credentialing as a socio-technical governance system rather than a technical infrastructure alone. The Capability Approach informs the framework's focus on whether credentialing expands displaced learners' real opportunities, while Collaborative Governance Theory explains the institutional coordination required to make credentials trusted and usable across borders.

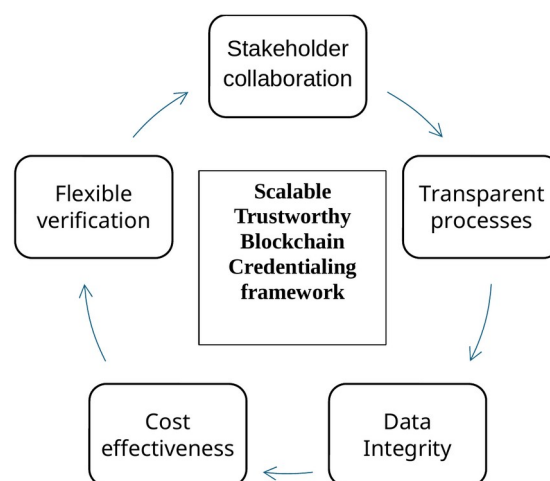
The purpose of the framework is not to prescribe a single blockchain platform. Rather, it identifies the governance conditions under which digital credentialing can support recognition of prior learning, protect user agency and enable cross-border mobility. Table 2 maps the five principles to the empirical problems identified in Section 4 and the supporting literature reviewed in Section 2.

Table 2 demonstrates how the proposed framework synthesises the empirical problems identified in Section 4 with the supporting literature and governance reference points reviewed in Section 2. The five framework principles draw on refugee credential recognition literature, blockchain credentialing research, data governance principles, international policy reference points and the study's two theoretical lenses. The Capability Approach

informs the framework's focus on whether credentialing expands displaced learners' real opportunities (Nussbaum, 2003; Sen, 1999), while Collaborative Governance Theory explains the coordination required to make digital credentials trusted and usable across institutional and national boundaries (Ansell & Gash, 2008; Emerson et al., 2012).

Figure 1

Governance principles for a scalable and trustworthy blockchain credentialing framework



The five governance principles

The five principles operate as interdependent governance conditions. Stakeholder collaboration establishes the institutional roles required for credential issuance, verification and recognition (Ansell & Gash, 2008; Emerson et al., 2012; Liu et al., 2023). Transparency and trustworthiness ensure that displaced learners understand and control how credentials are shared and assessed (Grech et al., 2021; Tan et al., 2023). Data integrity and security protect the evidentiary value of credentials while avoiding unnecessary exposure of sensitive personal data

(Delgado-von-Eitzen et al., 2021; Maestre et al., 2023; Singh et al., 2020). Cost-effective implementation prevents verification systems from shifting financial burdens onto displaced learners, particularly in low-resource and humanitarian education contexts (Alnafrah & Mouselli, 2021; UNHCR, 2024). Flexible verification enables partial records, RPL, multilingual access and professional re-entry pathways to be recognised across borders (Andersson, 2024; Limata et al., 2024; Scardigno et al., 2024).

International alignment and governance safeguards

The five principles require alignment with international legal, ethical and technical standards. IGF and UNESCO-informed principles provide a normative foundation for openness, inclusion, transparency, accountability and equitable access principles especially salient for refugee credentialing systems operating across jurisdictional and institutional boundaries. Technical protocols such as verifiable credentials, digital wallets and decentralised identifiers can support interoperability, but are insufficient without governance alignment on recognition rules, data protection standards, consent requirements, record-retention policies, dispute resolution and the legal status of digital credentials (Liu et al., 2023). The framework therefore requires not only technical interoperability but governance interoperability alignment between legal systems, institutional recognition rules, humanitarian principles and learner rights. Its contribution is socio-technical: it connects blockchain credentialing capabilities with the governance safeguards required to protect displaced learners and make recognition meaningful across institutional and national boundaries.

Implementation

Implementation principles

In this study, implementation assumes a permissioned or consortium-style credentialing ecosystem in which authorised issuers create or anchor credential proofs, learners control disclosure through wallets or equivalent access systems, and verifiers such as HEIs, employers and professional bodies confirm authenticity through agreed protocols (Grech et al., 2021; Helliard et al., 2020; Tan et al., 2023). The challenge is not simply to deploy a blockchain platform, but to translate the five governance principles into institutional processes, technical architecture, funding arrangements, data protection safeguards, user support and cross-border recognition agreements. Existing blockchain credentialing initiatives, including MIT's Digital Diploma Initiative, the University of Lille's credential deployment and the European Blockchain Services Infrastructure (EBSI), demonstrate that digital credentials can be issued and verified at institutional scale (Grech et al., 2021; Tan et al., 2023). However, these initiatives were not designed specifically for refugee education. Their relevance

depends on whether displaced learners can access the infrastructure, whether incomplete or disrupted records can be accommodated, whether sensitive data is protected, and whether host-country institutions are willing to recognise the resulting credentials. Implementation success for refugee credentialing should therefore be assessed not only by technical deployment, but by affordability, accessibility, data protection, institutional recognition and support for learner agency.

Table 3 summarises an implementation roadmap that moves from governance readiness to technical deployment, not the reverse. The first implementation question is not which blockchain platform to use, but whether the stakeholder ecosystem, recognition rules, data safeguards, cost model, and user support arrangements are in place. These implementation stages reflect the governance conditions identified in Section 4.

Critical safeguards and long-term sustainability

Three implementation safeguards are essential for refugee credentialing systems. First, data architecture must prioritise privacy by design. Sensitive personal information, including legal status, biometric data, location and displacement-related information, should not be placed directly on-chain because blockchain immutability can create risks if data is permanently recorded or difficult to correct. Hybrid storage models, where sensitive data is held off-chain while hashes or proofs are anchored on-chain, can support tamper-resistant verification while preserving the ability to update, correct or revoke records. Privacy-enhancing technologies, such as zero-knowledge proofs, may also support verification without unnecessary disclosure (Delgado-von-Eitzen et al., 2021; Grech et al., 2021).

Second, financial sustainability requires equitable cost allocation. Implementation involves platform development, cybersecurity, user support, training, translation, compliance, maintenance and long-term governance. A system that reduces costs for institutions but imposes fees on displaced learners would conflict with the framework's inclusive purpose. Subsidies, fee waivers, open-access verification portals or donor-supported infrastructure may therefore be necessary to prevent digital credentialing from becoming another exclusionary barrier (Crea, 2016; Dagar, 2023; Damelang & Kosyakova, 2021).

Third, evaluation must capture inclusion outcomes, not only technical performance. Relevant indicators include credential uptake by displaced learners, number of recognising institutions, verification time, cost per verification, multilingual support, successful RPL or admission outcomes, and appeals or corrections processed. These indicators show whether blockchain credentialing functions as an inclusive governance mechanism rather than only a technical record system. Sustainability also requires exit strategies, data portability, open standards and institutional continuity plans. Where lower-impact or non-blockchain verifiable credential architectures can

Table 3*Implementation roadmap for blockchain-based refugee credentialing*

Implementation stage	Key actions	Linked framework principles
Stage 1: Governance readiness	Identify stakeholders, legal authority, recognition partners, data protection obligations, funding model, and accountability arrangements	Stakeholder collaboration
Stage 2: Use-case selection	Select low-risk pilot credentials, RPL records, micro-credentials, or bridging programme certificates; assess whether blockchain is necessary	Transparency and trustworthiness
Stage 3: Technical architecture	Choose verifiable credential, wallet, DID, storage, consent, access, revocation, and audit mechanisms	Data integrity and security
Stage 4: Pilot and user testing	Test with displaced learners, HEIs, NGOs, employers, and recognition bodies; assess usability, language, cost, digital access, and support needs	Cost-effectiveness
Stage 5: Recognition and scaling	Formalise recognition agreements, verifier protocols, appeals, revised credential states, revocation, multilingual access, and cross-border verification procedures	Flexible verification

meet the same verification need, they should be considered to ensure proportionality and long-term sustainability.

The implementation considerations above show that the proposed framework should be evaluated not only as a blockchain deployment, but as a governance mechanism that enables displaced learners to use verified credentials for higher education access, recognition of prior learning, employment pathways and control over personal data.

Discussion

This section examines the theoretical and conceptual implications of the proposed governance framework. Building on the implementation considerations in Section 6, it argues that blockchain-based refugee credentialing should not be understood simply as technical infrastructure for storing or verifying records. Its value depends on whether governance arrangements enable displaced learners to convert prior learning into recognised educational, professional and social opportunities. The discussion is organised around three connected areas: the Capability Approach, Collaborative Governance Theory, and blockchain governance for refugee credentialing.

Credentialing infrastructure as a capability-expanding conversion factor

The first implication is that the Capability Approach can be applied to refugee credentialing by conceptualising credentialing infrastructure as a capability-expanding conversion factor. The Capability Approach focuses on individuals' substantive freedoms to pursue lives they value (Nussbaum, 2003; Sen, 1999). In refugee education, however, prior learning and professional skills may exist but remain unusable if institutions cannot verify or recognise them. The findings show that capability deprivation

may therefore arise not only from the absence of education or skill, but from the failure of recognition systems to convert existing learning into recognised opportunity.

This positions credentialing infrastructure as an important condition for expanding refugee capabilities. Blockchain-based credentialing becomes valuable only when it helps displaced learners convert prior learning into admission, RPL, professional registration, employment, retraining or cross-border mobility. The five governance principles identify the conditions under which this conversion can occur: institutional collaboration, transparent disclosure, evidentiary integrity, affordable access and flexible recognition pathways.

Collaborative governance under jurisdictional fragmentation

The second implication concerns the application of Collaborative Governance Theory to refugee credentialing contexts where the usual conditions for collaboration are weak or fragmented. Collaborative Governance Theory emphasises multi-actor coordination, trust-building and shared decision-making (Ansell & Gash, 2008; Emerson et al., 2012). Refugee credentialing, however, often involves actors located across different jurisdictions and institutional contexts, including origin-country issuers, host-country higher education institutions, ministries, embassies, professional bodies, employers, NGOs, technology providers and displaced learners themselves. In some cases, the original issuing institution may be inaccessible, destroyed, politically contested or no longer trusted.

The findings suggest that governance under such fragmentation cannot rely on pre-existing institutional alignment. It must be constructed through shared technical standards, trusted issuers, verifiable credentials, recognition agreements, data protection protocols and appeal mechanisms (Ansell & Gash,

2008; Emerson et al., 2012). Blockchain and digital credentialing infrastructure do not replace governance; rather, they provide evidentiary and procedural scaffolding through which governance can be coordinated across fragmented jurisdictions (Grech et al., 2021; Tan et al., 2023).

Contribution to blockchain governance and refugee credentialing literature

The study also contributes to blockchain governance and refugee credentialing literature by showing that trust and portability are governance achievements rather than technical properties. Existing blockchain credentialing and governance literature often emphasises immutability, decentralisation, fraud prevention and interoperability (Grech et al., 2021; Tan et al., 2023). While these features are important, the findings show that they do not automatically create recognition for displaced learners. A credential may be technically verifiable but still unusable if universities, employers, professional bodies or public authorities do not accept it.

For refugee credentialing, the central issue is therefore not whether blockchain can secure a record, but whether governance arrangements make that record meaningful across borders. The proposed framework links technical interoperability with governance interoperability through stakeholder roles, recognition rules, privacy safeguards, consent mechanisms, affordability and flexible pathways for incomplete documentation. This responds to the gap identified in the literature by integrating refugee lived experience, blockchain credentialing and governance theory into a framework designed specifically for refugee higher education. The study advances blockchain governance research by demonstrating that trust, portability and recognition are not inherent technical features, but outcomes of coordinated governance arrangements.

Limitations and future research

Four limitations should be acknowledged. The study was limited to English-speaking participants; interviews were conducted virtually, which may have excluded participants with unreliable internet access; the number of direct refugee participants was modest; and the framework has not yet been tested through implementation. Future research should engage more deeply with displaced learners across diverse conflicts, asylum and resettlement contexts, conduct longitudinal pilot studies of the framework, and examine digital literacy, environmental sustainability, platform governance and the socioeconomic impacts of blockchain-enabled credentialing on refugee integration and mobility.

Conclusion and future research

This study examined how blockchain-based credentialing can be governed to support refugee and displaced learners' access to higher education, recognition of prior learning and cross-border mobility. Drawing on 36 semi-structured interviews

across 16 countries, with participants from refugee education, higher education, technology, policy and humanitarian practice, together with international governance reference points, it identified five interrelated governance principles: stakeholder collaboration, transparency and trustworthiness, data integrity and security, cost-effective implementation, and flexible verification. These principles respond to fragmented recognition systems, lost documentation, opaque verification processes, high costs and the need for portable recognition across jurisdictions.

The study contributes to inclusive higher education and blockchain governance literature in two ways. Empirically, it shows that blockchain credentialing's value in refugee contexts depends not on technical immutability alone, but on governance arrangements that protect user agency, support institutional trust and enable recognition across borders. Conceptually, it applies the Capability Approach by positioning credentialing infrastructure as a capability-expanding conversion factor and specifies the relevance of Collaborative Governance Theory in contexts where recognition must be actively constructed across jurisdictionally fragmented systems.

Future research should test the framework through longitudinal pilot implementations, examine digital literacy and environmental sustainability dimensions, and conduct comparative studies across regions and legal systems to determine how the framework can be adapted to local recognition contexts while maintaining cross-border interoperability.

The central governance question for refugee higher education is therefore not simply how credentials can be digitised, but how digital credentialing systems can recognise the knowledge, skills and aspirations of people whose educational pathways have been disrupted by displacement, while protecting their privacy, dignity and agency.

Declarations

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Participants received information on the study purpose, voluntary participation, confidentiality and the right to withdraw. Informed consent was obtained, data were stored securely and identities were anonymised using participant codes.

Author contributions. All authors contributed to conceptualisation, methodology, investigation and formal analysis. Anju De Alwis contributed to writing – original draft; Anup Shrestha contributed to writing – review and editing.

Data availability. The data are not publicly available because they relate to individual participants, whose anonymity is protected in accordance with the approved ethics application.

Generative AI disclosure. Generative AI tools were used solely to assist with language editing and readability improvements; they were not used for idea generation, conceptual development, analysis, interpretation, or the creation of original scholarly content.

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